

BY DAVID D. REDHED

THE LISA 2: APPLE'S ABLEST COMPUTER

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Lisa may be the most underrated machine in the history of the microcomputer industry. The recently introduced Lisa 2 line is more versatile and powerful than any other machine in its under-\$7000 price category. In spite of this, the technical press remains preoccupied with Macintosh and the public remains enthralled with IBM.

Granted, Apple's marketing efforts on behalf of Lisa 2 have been less than herculean. And a dearth of software support still hobbles the entire Lisa line. Yet I see Lisa as the premier Apple offering. I've taken the time to look closely at this innovative, and now cost-effective, computer. There is simply no other machine in Lisa's price range that approaches its versatility, innovation, and power.

The three Lisa models—Lisa 2, Lisa 2/5, and Lisa 2/10—differ only in the amount of attached hard-disk storage they offer (none, 5, and 10 megabytes, respectively). The least expensive model, the Lisa 2 (\$3495), is akin to a wide-screen Macintosh with half a megabyte of main memory. The unit also sports a single 3½-inch disk drive (400K-byte capacity) for external storage. The only apparent purpose for this stripped-down Lisa is to provide a vehicle that will run Macintosh software with four times the memory capacity of the Macintosh. No other commercially available software will run on the Lisa 2.

The Lisa 2/5 (\$4495) adds an external 5-megabyte hard disk. The 2/10 (\$5495) provides an internal 10-megabyte hard disk.

When it comes to expanding Lisa's hard-disk capacity, there are many ways to go. The Lisa 2 and 2/5 can be upgraded to 2/10 status for \$2795. The Profile drive on an upgraded 2/5 can be connected through a parallel card (\$195) for a total of 15 megabytes of storage. A 20-megabyte system can also be configured using all Apple disks for \$8680. There is one external parallel port on both the Lisa 2 and the 2/5 that is intended as the connection point for the 5-megabyte Profile drive. This port (the default port) is internal in the 2/10, since the hard-disk drive is internal. Any additional drive must always connect via a parallel card, whether it is augmenting a Profile drive or a 10-megabyte drive. Lisa now supports a 70-megabyte drive manufactured by Priam and distributed by Tecmar. UNIX and XENIX users have the option of attaching drives from Corvus and Sunol in sizes from 20 to 100 megabytes.

All models of Lisa have two serial ports intended for use with printer and modem. Currently, no printers other than the Apple-provided dot-matrix and letter-quality printers run with Apple-developed software. Both the ImageWriter (dot-matrix) printer and the letter-quality printer connect through the serial ports (the Macintosh software expects a dot-matrix printer to be connected to serial port B only). UNIX and XENIX users have other printer options.

Lisa 2 has three expansion slots for peripheral cards. So far, however, only three such cards exist. Apple sells a parallel card providing two ports, and Santa Cruz Operations sells a serial card

offering four ports. The Apple card is used primarily for attaching additional Profile drives but was originally used to support the first Lisa dot-matrix printer that required a parallel interface. The serial card is primarily used for supporting terminals under multiuser (UNIX or XENIX) operating systems. The Priam disk is attached through a special-purpose interface card.

Unlike Macintosh, Lisa has both a high-resolution bit-mapped display and a character-generator display that supports a standard 24 by 80 screen. Having a standard screen-display option permits some conventional software to run on Lisa without display output conversion. This feature is critical to XENIX and UNIX users.

LISA OPERATING ENVIRONMENTS

The 11 different operating environments available on Lisa fall into three broad categories: those supporting business applications, those supporting business applications and software development, and those used purely for software development.

Three distinct user environments focus on business applications only. These are the Office System with fully integrated applications, the Office System with QuickPort applications, and an application-oriented shell running under the Lisa Operating system.

The original Lisa software consisted only of applications that were fully integrated into the Office System. The QuickPort applications available on Lisa 2 are a new kind of application that share some, but not all, of the Office System facilities. The Lisa operating system also supports multiple shells for the purpose of creating separate user environments.

The Office System contains three elements: Desktop Manager, LisaGuide, and Lisa 7/7, a seven-function integrated program. Desktop Manager is actually a user-oriented operating system placed on top of a conventional operating system. The icons and windows and all of the actions taken to manipulate them are part of the Desktop Manager. LisaGuide is a tutorial program designed to familiarize users with Lisa's graphic interface. Lisa 7/7 is Apple's attempt to

offer an integrated package like Lotus 1-2-3. Given its greatly reduced price of \$695 for all seven functions, 7/7 should be a competitive piece of software. Current owners of Lisa Office System software can upgrade to the new release for \$150.

The seven functions provided include:

- LisaCalc, a 255 by 255 spreadsheet
- LisaDraw, presentation-quality graphics drawing
- LisaGraph, graphs of discrete functions
- LisaList, to display rows of two-dimensional tables
- LisaProject, a cost, time, and resource scheduling program
- LisaTerminal, a communication utility
- the LisaWrite word processor

These applications are called "fully integrated" because they have access to all the Desktop Manager facilities. The seven functions provided in Lisa 7/7 include window support, pull-down menus, keyboard and mouse support, and the transfer of different kinds of

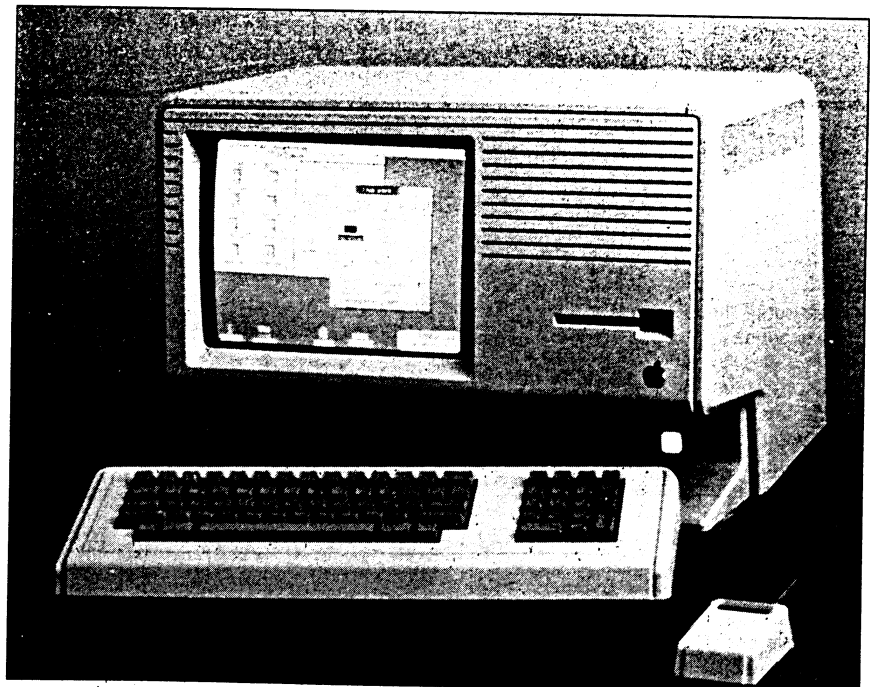
data between the various applications.

Apple now considers Lisa 7/7 a complete integrated office application. In fact, Apple has discontinued support for the Toolkit, the development tool required to produce fully integrated applications. That is not a very encouraging outlook for developers or for users who want extensions to the Office System.

Software developers do have an alternative. It is called QuickPort. As the name implies, this utility provides a quick way to transport software into the Office System. QuickPort applications execute in a window on the desktop but do not have pull-down menus and associated mouse interactions. The window may be divided into two panels.

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PHOTOS BY J.C.M. DOWNS

Photo 1: The Lisa 2 is an aesthetically attractive machine that occupies a minimum of desk space. An internal 10-megabyte hard disk provides plenty of storage. Those needing less storage capacity can purchase the machine with an external 5-megabyte Profile hard disk.

THE LISA 2

one for text and one for graphics. The contents of the graphics panel can be copied onto the clipboard and pasted into any application that can take graphics information from a LisaDraw document. Information from the text panel of the window can be copied to the clipboard and taken to any application that can receive text lines (e.g., LisaTerminal or LisaWrite).

BUSINESS APPLICATIONS AND SOFTWARE DEVELOPMENT

Four distinct operating environments support both program development and business applications. Those are MacWorks, the Workshop from Apple Computer, UNIX from UniPress, and XENIX from Santa Cruz Operations under license from Microsoft. MacWorks is simply a program that allows Lisa to run Macintosh software. The Workshop is very similar to the UCSD Pascal system. UNIX and XENIX both use shells to provide a command-driven user interface to an underlying operating system. Users must already have or be willing to develop proficiency in computers before they can readily operate in any of these last three environments.

When you start up Lisa under Mac-

Works, a portion of the Macintosh operating system adequate to handle disk I/O is loaded into memory. In fact, the equivalent of the 64K-byte operating-system ROM is loaded and made accessible in a manner that is transparent to the Macintosh applications. From this point on, Lisa 2 functions just like a Macintosh, with two major exceptions—the display screen is larger and the central processing unit is slower. Lisa's display area is physically larger than Mac's (10½ versus 8 inches diagonally). It also has more pixels in both directions (720 by 364 versus 512 by 342), and the pixels are shaped differently. The pixels in Lisa 2 are 50 percent higher than they are wide. Macintosh pixels are square. These differences combine to provide a larger working area. Unfortunately, Macintosh graphics appear to be stretched in the vertical direction when run on Lisa. Text looks surprisingly good, but circles become ellipses and squares mutate into rectangles. Most nonmathematical shapes are acceptable in appearance, but if you create graphics on Lisa 2 using MacPaint, you are in for a rude surprise. When you print the results, the printer will show the true form of the object, not what is on the screen.

The central processor on Lisa runs at 5 MHz versus 8 MHz on the Macintosh. The 5 to 8 ratio holds for graphic operations, but the ratio is 5 to 6 for most other operations.

The MacWorks program, first available in April 1984, would not function with Lisa's hard disk. A version released in September 1984 permits use of the Profile drive, and Mac files will coexist with Lisa Office System and/or Workshop files. (They will not coexist with UNIX or XENIX files.) Attempts by Apple to develop utilities for file transfer between Macintosh and Lisa applications have not been successful. Developing programs using Macintosh BASIC or some other high-level language is practical on Lisa because of the extra available memory. However, these programs must be small enough to run in the Mac's restricted memory.

THE WORKSHOP

Because the Workshop's user interface is similar to UCSD Pascal's, Apple II or III Pascal users will feel at home rather quickly. The program contains many features not found in UCSD Pascal, including a mouse-driven editor and sophisticated file-manipulation facilities. The Workshop contains all Lisa and

Table 1: Lisa 2/5 and 2/10 performance figures.

	Empty LisaWrite file			37,000-byte LisaWrite File			Empty LisaDraw file			40,000-byte LisaDraw File		
	2/5	2/10	Ratio 2/10 to 2/5	2/5	2/10	Ratio 2/10 to 2/5	2/5	2/10	Ratio 2/10 to 2/5	2/5	2/10	Ratio 2/10 to 2/5
Measured times in seconds												
Test run immediately after start-up												
Open first time	29	25	0.9	33	28	0.8	34	27	0.8	98	90	0.9
Save and put away	15	20	1.3	63	51	0.8	14	16	1.1	13	14	1.1
Open second time	4	3	0.8	7	6	0.9	6	5	0.8	69	66	1.0
Set aside	6	3	0.5	7	6	0.9	6	5	0.8	8	8	1.0
Test run after two other applications are active												
Open first time	37	29	0.8	39	31	0.8	36	26	0.7	100	86	0.9
Save and put away	16	16	1.0	52	51	1.0	10	10	1.0	13	12	0.9
Open second time	5	4	0.8	7	6	0.9	7	5	0.7	68	70	1.0
Set aside	6	4	0.7	7	7	1.0	6	5	0.8	8	8	1.0
Save a duplicate	12	14	1.2	16	20	1.2	10	9	0.9	18	13	0.7
Copy disk to hard disk	3	3	1.0	17	15	0.9	4	3	0.8	16	15	0.9
Copy hard disk to disk	4	3	0.8	18	20	1.1	4	4	1.0	20	20	1.0

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Macintosh software-development tools supported by Apple Computer. Since Pascal is the underlying language of Lisa software, all of the operating-system interfaces are in Pascal form. A 68000 assembler is available that can be used to create programs and procedures to run in the Pascal environment. A C compiler is also available, and procedures written in C can be called from Pascal (or vice versa). Both the Pascal and C compilers have an option to generate code for either Lisa 2 or Macintosh.

In releases 1.0 and 2.0 of the Workshop, Apple offered the BASIC Plus language (compatible with Digital Equipment Corp. BASIC) and Cobol (an extension of ANSI 74). Only BASIC will be offered under release 3.0, but Apple will offer no technical support. COBOL has been dropped due to an insufficient number of buyers.

Using the Workshop with Pascal, C, and the 68000 assembler, you can develop conventional keyboard-oriented applications. Further, by using a multitasking operating system, QuickDraw graphics utilities, and the mouse interaction utilities supplied by Apple Computer, you can create any kind of environment you like. You can duplicate all the visual effects and user-interface features you see in the Office System with the utility software supplied in the various elements of the Workshop.

Extensive documentation of QuickDraw (the comprehensive graphics package used in the Office system) is included, along with some sample programs. The documentation of the operating-system interfaces is also good, and access to low-level information through these interfaces is excellent.

UNIX

The UniPress Inc. version of UNIX is based on Bell Labs System V UNIX. The operating system is supplied with a C compiler, standard UNIX utilities, and Berkeley enhancements (visual editor, C shell, terminal independent library). The entire package sells for \$1495. Hard disks from 20 to 100 megabytes are supported, and Ethernet networking is also available. Corvus and Sunol are the vendors of the hard disks that can be

(continued)

AT A GLANCE

Name

Lisa 2

Manufacturer

Apple Computer Inc.
20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010

Size

13.8 by 18.7 by 15.2 inches; 48 pounds

Power Requirements

90-130 V AC, 48-68 Hz (U.S. model)
180-260 V AC, 48-68 Hz (foreign model),
150 watts (both models)

Processor

MC68000, 5-MHz clock

Interface Slots

Three slots for peripheral interface cards

Peripheral Connectors

All models have a mouse connector, keyboard connector, and two serial-port connectors (25-pin D-shaped plugs). The Lisa 2 and 2/5 also have a parallel connector intended for connecting a hard disk (25-pin D-shaped plug)

Keyboard

2.7 by 18.7 by 6.5 inches;
4 pounds

Memory

524,288 bytes (1/2 megabyte) standard for all models; expandable to 1,048,576 (1 megabyte)

Mass Storage

All models have one Sony 3 1/2-inch drive with a 400,000-byte capacity; Lisa 2/5 has a 5-megabyte external Profile hard-disk drive; Lisa 2/10 has a 10-megabyte internal hard-disk drive

Video Display

12-inch diagonal tube with a displayable area of approximately 8 by 6 inches; 720 pixels horizontally and 364 pixels vertically; 90 pixels/inch horizontally and 60 pixels/inch vertically (pixels are 50 percent higher than they are wide); bit-mapped graphics page requires 32,760 bytes; screen refresh rate is 60 Hz; horizontal line rate is 22,900 Hz; dot rate is 20 MHz

Options

Parallel interface card with two ports (25-pin D-shaped plugs)

Hardware Prices

Lisa 2:	\$3495
Lisa 2/5:	\$4495
Lisa 2/10:	\$5495
Conversion of Lisa 2 or 2/5 to a 2/10:	\$2495
Conversion of original Lisa to a 2/5:	\$595
1/2 megabyte memory:	\$1495
Parallel interface card:	\$195
ImageWriter dot-matrix printer:	\$595
Daisy-wheel printer:	\$2195

Software Prices for Apple-Supplied Software

Lisa 7/7:	\$695
(contains Desktop Operating System, LisaCalc, LisaDraw, LisaGraph, LisaList, LisaProject, LisaTerminal, LisaWrite)	
Upgrade from version 2.0 of the Office System applications:	\$150
Pascal Workshop:	\$395
MacWorks:	\$195

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purchased through UniPress as part of a complete package for Lisa. UNIX will also work with hard-disk systems sup-

plied by Apple.

Several applications programs are available from UniPress: the EMACS

editor system, the LEX word processor, UNIFY database, /RDB Database Tools, and the Phact ISAM file system. Of

The Lisa Office System

In July 1984, Apple released version 3.0 of all the Lisa software. What used to be marketed as seven integrated applications is now called Lisa 7/7, a single application with seven functions. The operating system is included for \$695, and release 2.0 owners can upgrade for \$150, even if they do not own all seven applications.

The seven functions available in Lisa 7/7 cover all the common activities in the business office, with the exception of accounting. The Lisa series of integrated programs can calculate, draw, graph, sort and maintain lists, make projection decisions, communicate at 110 to 19,200 bps (bits per second), and do word processing.

THE PROGRAMS

LisaCalc is a spreadsheet calculator that offers you a 255 by 255 matrix, natural-order evaluation, and up to 126 data digits visible on the screen. The program locates circular references and each column of the spreadsheet may have a different width. The spreadsheet also performs calendar-date calculations.

The 3.0 version of LisaCalc adds the natural-order evaluations and circular references as well as internal rate of return, a display of both storage requirements and recalculation time, and an option to print with any combination of headings, grid lines, and row and column titles.

LisaDraw is especially suited to presentation graphics. Its maximum document size is four feet by eight feet, and it will print along either axis of the paper. Images are stored in mathematical form and can be easily edited and resized.

Lisa's 3.0 release of LisaDraw offers color output to Canon's color printers for the first time. You can also print up to an 11-inch boundary. Your images can be rotated, flipped, and reduced up to 25 percent.

LisaList offers users an elementary relational database, eight data types (text, number, social security, zip code, date,

time, telephone, and cost). You can sort your data on multiple columns in ascending or descending order and can search the list in any of six ways. Columns can be added or deleted, and any column can be hidden from display.

Version 3.0 of LisaList offers some increase in integration.

LisaGraph offers the same table of values as LisaCalc, 255 by 255. You can draw full-page, half-page, and quarter-page and can reduce the document to fit the display screen. Under LisaGraph, you have seven graph types—point, line, bar, stacked bar, 3-D bar, pie, and area.

The stacked bar, solid bar, and area graphs are new with version 3.0 and so is the display of linear regression and line correlation coefficient. You can also use color output to Canon's new color printer and add text anywhere on the graph.

LisaProject is a task and cost scheduler performed with Pert-chart-like diagrams. Resource and task bar charts and task cost charts are derived automatically from the schedule chart. The critical path is calculated and displayed, as are early-start/early-finish and late-start/late-finish. Fixed costs may be specified for each task and a maximum of five labor resources.

The task cost charts are new with version 3.0, as is the ability to specify resource costs and project those costs onto resource and task charts. You can also fix task costs in this new iteration of LisaProject.

LisaTerminal supports XON/XOFF protocol and can communicate anywhere from 110 to 19,200 bps. A window contains all transmissions, and you can scroll backwards. You can maintain multiple connections and switch back and forth between them. You can also retain custom transmission setups. Version 3.0 of this program offers very little that is new.

Under LisaWrite your document size is limited only to the amount of hard-disk storage available. Multiple type sizes and proportional spacing are available to you. On-screen rulers let you adjust the margins of your copy, and LisaWrite's search facilities include case and wildcard options.

Add to the above features an 80,000-word spelling checker available in version 3.0 and a 750-word extension for words of your own.

USING LISA 7/7

The Lisa programs are integrated in three distinct ways: they each work from a common user interface; data can be transferred between most, but not all, of the modules; and you can suspend activity in one program and activate any other.

With its uniform programming conventions, Lisa's 7/7 really excels. Text-editing conventions are identical across all modules and in all circumstances. Whether you are naming a document, entering text in a document, or supplying a set of characters to search a document, you edit text in the same way. Also, the pull-down menus of Lisa are used in all functions and always operate the same way.

The various data-transfer paths are shown in figure 1. Table 1 shows you the data formats that each of 7/7's functions can create, receive, and/or send.

Lisa's ability to switch quickly between programs is a direct consequence of the multitasking operating system. Under 7/7, your current function is deactivated when you switch to another program. No matter how long you stay away or how many other functions you activate in the meantime, returning to the original program will recapture the state at which it was

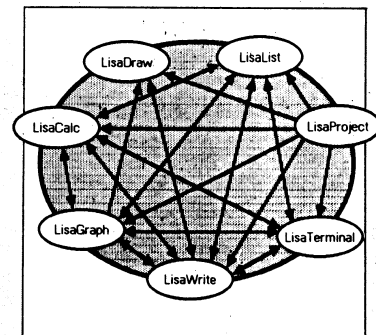


Figure 1: The paths between modules along which data can be transferred.

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course, many other applications are available for UNIX, but not necessarily through UniPress. The UniPress system

contains standard UNIX development tools such as a C compiler, text processor, utilities, and the multiuser

kernel. By nature UNIX is a multiuser system. A single-user run-time system is
(continued)

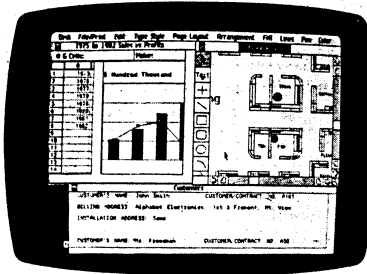


Photo 1: Three windows in Lisa showing different functions: LisaDraw, LisaWrite, and LisaGraph. LisaDraw is currently active.

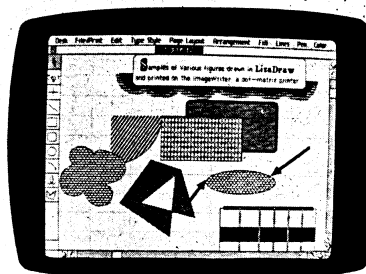


Photo 2: A sample of figures created by LisaDraw.

interrupted.

This same kind of switching applies if you activate the identical function on different documents. Thus you could have three or more word-processing documents in progress and switch back and forth between them without disturbing the states of any of them. This kind of integration is very difficult to achieve with conventional microcomputer operating systems.

Photo 1 is a screen display of three windows belonging to three different functions of Lisa 7/7: LisaDraw, LisaGraph, and LisaWrite. The dark shading around the name "Floor Plan" indicates that this is the currently active window created by LisaDraw.

Successively activating the other two functions and returning to "Floor Plan" takes a total of 14 seconds. This is contrasted with the approximately two minutes it took to open all three documents initially.

In a similar manner, if one LisaGraph document is closed and another one is opened, the only time required is that taken to load the new document and connect LisaGraph to it. The LisaGraph program is already in memory and does not have to be reloaded. In this case, the new document is displayed in a new window in just 20 seconds, in contrast to the 43 seconds for the first document opened by LisaGraph.

Obviously, the megabyte of memory in Lisa will hold only so much; then things must be moved out to make room for additional documents or functions. Even with small documents, all seven functions will not fit in memory simultaneously. I have found that three functions with moderate documents (5 to 10 pages) or two functions with fairly large documents (15 to 25 pages) will cohabit memory without requiring significant swapping to the hard disk.

Lisa 7/7 is a powerful package for the price—\$695. With a Lisa 2/5, the extra 1/2-megabyte of memory, and a dot-matrix printer, the total system price comes to about \$7300. If the functions in Lisa 7/7 satisfy your requirements, there is not a better buy.

—David D. Redhed

Table 1: Types of data that a Lisa 7/7 program may create, receive, or send.

	Text	A Table	Graphics
LisaCalc		Create Receive Send	
LisaDraw			Create Receive Send
LisaGraph		Create Receive Send	Create Send
LisaList		Create Receive Send	
LisaProject		Create Send	Create Send
LisaTerminal	Receive Send	Receive Send	
LisaWrite	Create Receive Send	Create Receive Send	Receive Send

Text = one or more multiple-line paragraphs separated by carriage returns

A Table = multiple lines of text containing tabs and separated by carriage returns (tabs indicate columns and carriage returns indicate rows)

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also available as an option (\$495), however. Additional languages that can be used with the system include FORTRAN, Pascal, BASIC Plus, RM COBOL, SMC BASIC Four, and Irvine Ada.

XENIX

XENIX for Lisa 2 is based on UNIX System III and is available from the Santa Cruz Operation. The system includes the full set of XENIX utilities, the C shell, the full-screen visual editor, system-administration commands, electronic mail, and support for UNIX networking. XENIX also provides "vsh," the visual shell that serves as a menu interface.

From one to four Profile drives can be supported by XENIX in addition to the 10-megabyte built-in disk of the Lisa 2/10. Support for other disks is not currently available, but future releases will include support for Priam and Sunol drives. XENIX will support two additional terminals through the two serial ports on Lisa. Santa Cruz Operations provides a four-port serial board to go into the standard Lisa slots. Up to two of these may be used to support as many as eight terminals.

Networking is supported through two separate features, "uucp" and "Micnet." The uucp feature provides point-to-point communication between predetermined locations. Micnet is a full networking facility for user-to-user communications between a variety of locations. The XENIX Software Development System can be added to the basic operating system described earlier. This package supplies the C compiler and various utilities to support the production of C programs, including an interactive debugger and a source-code control system.

SOFTWARE DEVELOPMENT ONLY

Lisa 2 and Macintosh software development done by Apple so far have taken place entirely on Lisa, and the tool development by Apple has been extensive. Pascal Workshop is the host environment for all development work, and there are four separate development tools currently available. QuickPort is used to move conventional applications into the Office System. Macintosh Supplement is used to develop Macintosh software. The Toolkit is an unsupported system used to develop fully integrated applications for the Office System. Pterodactyl Software supplies an IBM BASIC Compiler with utilities that is used to convert BASIC programs written for the IBM PC for use on Lisa.

QuickPort supplies a window on the Desktop in which non-Desktop-integrated applications can execute in a conventional manner while gaining several of the Desktop features. All of the window management and icon manipulations that are part of the Desktop environment are available to users. Inside the application window, there is no support for pull-down menus or mouse

functions. Any applications desiring those features will have to provide all the graphics, menu handling, and mouse interaction. All of the utility software to do these things is supplied in the Workshop via Pascal units. This means that each developer will have to produce his own set of logic to create a user interface. It is not even possible to take advantage of existing functions used by the current Desktop applications. (These belong to the Toolkit environment.)

The positive side of QuickPort is that conventional applications that are brought over to Lisa and converted to run under the Workshop can be run on the Desktop with a minimum of changes. QuickPort is actually an application developed with the Toolkit—an application designed to run other applications. Quickport programs may consist of any combination of Pascal, C, and assembly-language code. Once a program is running in the Workshop, it can then be packaged using a special set of libraries supplied by Apple. This new package is then installed in the Office System.

Each application automatically has a portion of its window devoted to text display, and the ordinary WRITELN and READLN functions of Pascal are routed to the window. You can copy text to or from the clipboard just as with any other desktop application. In addition, you can split the window into scrollable portions, either horizontally or vertically. The application may specify a buffer size to control how much information is kept available for scrolling backwards. Optionally, an application can request a portion of the window to be set up for graphics. Any QuickDraw graphics performed by the application will be displayed in the designated portion of the window. The contents of the graphics panel can be copied out to any other desktop application that is capable of accepting graphics information (e.g., LisaDraw, LisaWrite). Thus, QuickPort is a valuable tool if you want to quickly get an application into a partial Lisa desktop environment. The Toolkit and QuickPort are the only development tools that produce software for the Desktop. Applications created with other tools, excluding those for Macintosh, must run in conventional operating environments like the Lisa

Conversion to the Lisa 2

By the time this is published, most owners of the original Lisa will have converted to the Lisa 2. There are three parts to the conversion process: getting all your files ready to be converted, making the actual hardware modifications, and updating to the new system software.

The most troublesome (and potentially risky) part of the conversion is getting all your files on the Profile drive before converting the hardware. This is necessary because the new system does not have any software drivers for the old 5¼-inch disk drives. If you convert and then find some files you forgot, there is no easy way to recover them. For everyone except developers the hardware conversion is done by a dealer. (Developers are given the kit to make the conversion themselves.) It involves swapping the old 5¼-inch Apple drives for the new 3½-inch Sony drive, swapping some integrated-circuit chips, and cutting one or two resistors off a board. In my case, the conversion went very smoothly.

The last step is to update the Profile drive with the new system software. All Lisa 2 conversion kits contain release 2.0 of the Lisa software system, which involve modifications down at the disk-directory level. When you update the drive, all the file-formatting changes are made at the same time, although users are not really aware that this is happening.

Once you have converted, you are unable to do a disk-to-disk copy; you must go through the Profile drive as an intermediate step. —David D. Redhed

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Workshop, UNIX, or XENIX.

The Macintosh Supplement to the Workshop consists of additional libraries of routines to support the development of Macintosh software. The standard Pascal compiler, code generator, and linker all have options to support Macintosh development. This supplement, along with documentation called *Inside Macintosh*, is available to interested parties willing to pay \$250.

The development approach involves creating the source code on the Lisa 2, compiling it, and then transferring object code to Macintosh for checkout. This transfer is typically done by creating a Macintosh disk on Lisa. An alternate route is through a direct communication line connected to the serial ports.

IBM BASIC COMPILER

A BASIC compiler for the Workshop, available from Pterodactyl Software, converts IBM PC BASIC programs to run on Lisa. Compiled into 68000 code, converted programs should run considerably faster on Lisa than on a PC. Given the 1-megabyte Lisa memory, applications could be modified to run substantially larger problems than on a PC. Communication programs are also available from Pterodactyl to transfer code from the PC to the Lisa.

PERFORMANCE

Lisa has taken hard knocks for performance, and not without justification.

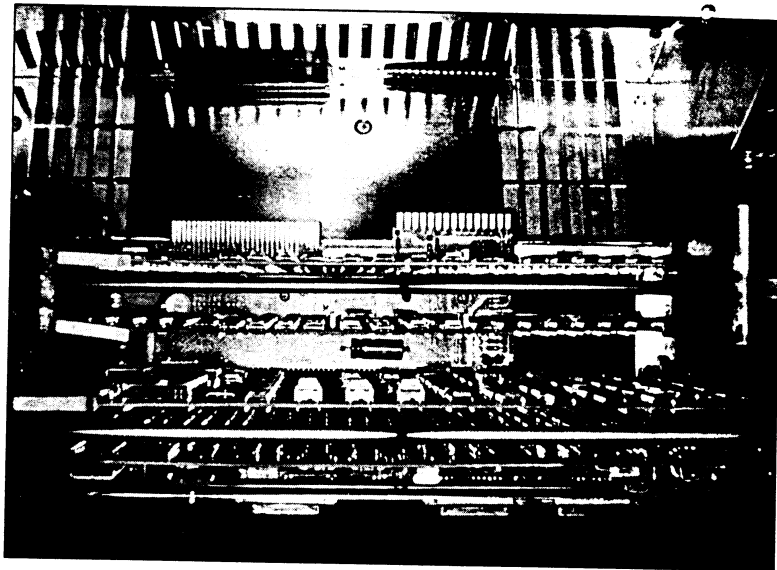


Photo 2: The four printed-circuit boards that make up Lisa's electronics are mounted in a sandwich within the card cage. Two memory boards, a CPU board, and an I/O board are included. All assemblies are color-coded and easily removed for servicing.

The first release of the Office System software was quite slow when doing I/O (input/output). Version 2.0 of the software, which improved the I/O speed quite a bit, was released in January 1984. I have not seen any comprehensive comparisons, but company claims indicated a 60 percent reduction in time for certain operations. My experience

(continued)

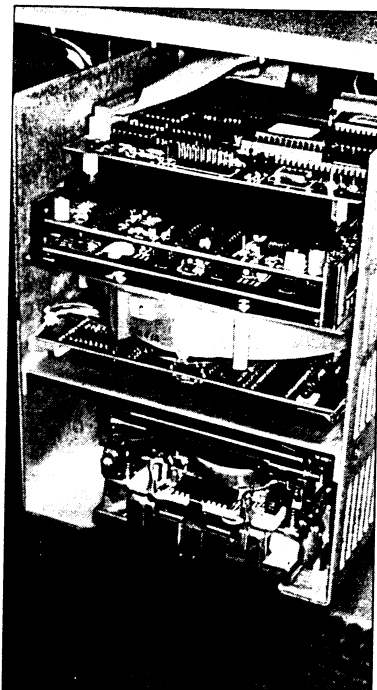


Photo 3: A close-up of the 10-megabyte drive and the Sony Micro-drive on the Lisa 2/10.

Table 2: Pascal I/O benchmark results.

Test #	Description	Time in seconds		Ratio 2/10 to 2/5
		2/5	2/10	
1	Write 1024 text lines of 8 bytes each (WRITELN)	11.0	11.8	1.1
2	Read 1024 text lines of 8 bytes each (READLN)	6.5	6.4	1.0
3	Write 8 text lines of 1024 bytes each (WRITELN)	8.0	9.3	1.2
4	Read 1024 text lines of 8 bytes each (READLN)	4.8	5.0	1.0
5	Write 1 text line of 8192 bytes (WRITELN)	8.1	9.0	1.1
6	Read 1 text line of 8192 bytes (READLN)	5.8	6.2	1.1
7	Write 8192 bytes in a single block (BLOCKWRITE)	1.5	2.3	1.5
8	Read 8192 bytes in a single block (BLOCKREAD)	1.4	1.4	1.0
9	Write 100 records of 100 bytes each (sequential PUT)	7.3	7.8	1.1
10	Read 100 records of 100 bytes each (sequential GET)	1.4	1.4	1.0
11	Read 100 random records of 100 bytes each (random GET)	5.8	7.4	1.3

THE LISA 2

The industry may end up adopting Lisa technology in small pieces over the next few years.

is that the average improvement was more like 40 percent.

Table 1 contains some of my own performance figures for the Lisa 2/5 and 2/10. The 10-megabyte disk was 10 to 15 percent faster for most operations. All these tests were run under the Office System, release 2.0. Release 3.0 is not supposed to have any performance improvements, but I have not been able to verify that the performance is unchanged.

When trying to evaluate the performance of the Office System in absolute terms, you should take several things into account. "Opening a document" in Lisa includes more activities than in most systems. The 33 seconds required to open a 37,000-byte LisaWrite docu-

ment for the first time after system start-up made me wonder what exactly was going on. Actually, I discovered, quite a bit. First, the LisaWrite program is being brought into memory and activated. Second, a copy is made of the requested document. In Lisa you never work on the original. Since opening an empty document still takes 29 seconds, initiating LisaWrite accounts for most of the time required by the larger document. Note that opening the same document the second time takes just 7 seconds.

An additional factor affecting performance is the underlying overhead of a fail-safe system. The Lisa Office System is capable of recovering all the data files on the hard disk even if the main catalog is lost or damaged. This is accomplished by redundant storing of enough information to rebuild the entire directory. This fail-safe mechanism adds significantly to I/O times. You might argue that you would rather risk an infrequent loss of data than suffer speed degradation on each and every I/O operation. That, however, is a system design issue and not a valid criticism of system performance.

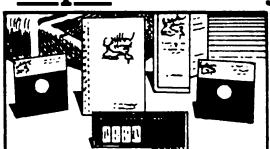
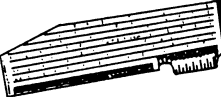
I also ran some tests on the 2/5 and the 2/10 for 11 different Pascal I/O operations. Here the 10-megabyte disk was never faster than the Profile drive (contrary to the Office System results). Most operations were about 10 percent

slower, and one operation was 50 percent slower. Table 2 shows the individual results along with a characterization of the type of Pascal I/O used. I am unable to reconcile these results with those from the Office System tests. I can only assume that the difference is due to a different kind of I/O logic used by the Desktop Manager.

CONCLUSIONS

It's fair to say that Lisa 2 gives its owners the freedom to run a wide variety of operating systems and applications. Its large memory and ability to use several sizes of hard disks are major factors in its versatility. Lisa's uniqueness as new technology has faded. And though Macintosh has pushed Lisa into the background, it may actually spur interest in Lisa over the long term. Further, until Macintosh is supplied with more memory, Lisa is the only practical way to run even moderately large Macintosh applications.

So far, Apple Computer does not seem inclined to market the Lisa aggressively or to give full support to Lisa software. In spite of this, I continue to think that the technology represented by the Office System is a giant step forward. It may well be that while the industry is not able to embrace it totally, it will end up adopting Lisa technology in small pieces over the next few years. ■

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